FINAL REPORT

CERTIFICATION OF LEAN BEEF PRODUCTS

Prepared for:

Texas Cattle Feeders Association

by:

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ABSTRACT

Twenty-nine sides from lightweight heifer carcasses, ranging from 113 to 250 kg, were fabricated into wholesale and retail cuts using standardized procedures. Retail cuts were trimmed to either zero or 0.64 cm of outside fat and analyzed for total fat content. Mean fat content of all retail cuts at the zero trim level (except the large end of the rib) was less than ten percent. At the 0.64 cm trim level, only steaks from the round and rump roast were below the ten percent fat level.

Retail cut yields from the chuck, rib, loin and round for both trim levels were considerably lower than those reported in other studies. Retail cut yield from the four major wholesale cuts increased significantly from the zero to the 0.64 cm trim level. Percentage carcass fat as determined by specific gravity was not a good indicator of carcass fatness in this study.

Marbling score and adjusted fat thickness were the best indicators of overall carcass fatness. Regression equations using these and other carcass variables were developed to predict total amount of fat, lean and bone trimmed from the four major wholesale cuts, percentage fat in the weighed composite and fat content of retail cuts at each trim level.

INTRODUCTION

In the last five years, consumers in the United States have become more diet-health conscious. This trend, as reported by Yankelovich, Shelly and White (1985), is "eat lean to be lean." The report indicated that about 50 percent of consumers are concerned about the diet-health aspect of beef. This figure is up from 33 percent in a similar report in 1983. Furthermore, results from the National Consumer Retail Beef Study (Savell et al., 1987) indicate that consumers are willing to pay a slightly higher price for closely trimmed cuts and that offering closely trimmed retail cuts instead of cuts with one-half inch (1.3 cm) of external fat can increase sales.

The change in consumer attitudes toward beef has been reflected in changes in retail merchandising. Many major supermarket chains are now selling beef trimmed to 0.25 in (0.64 cm) or less. Retailers require beef carcasses and primal cuts with a high proportion of saleable lean and a minimum of waste fat to be cost-competitive. As a result, an increase in the demand for carcasses with a lower numerical USDA Yield Grade should be expected.

The increase in demand for leaner beef has opened the possibility for marketing beef using private branding. This system allows the packer to characterize a particular type of carcass, primal cut or retail cut, and to obtain permission to use the label "lean" on the product. Several of these applications have already been issued (Key-Lite, Natural-Lite, Natural).

Current USDA regulations (USDA, 1986b) state that terms such as "lite", "light" or "lightly" may be used in labels of meat products that contain at least 25 percent less fat than a similar product. For products that are unquestionably low in fat, USDA regulations require the product to contain no more than 10 percent fat. According to USDA's Agricultural Marketing Service, the typical beef carcass is a USDA Choice quality grade, Yield Grade 3. Based on this information, carcass composition data published in the literature and information in USDA Handbook 8-13, Composition of Beef (1986a), they have estimated the fat content of a typical carcass to be 31 percent. Therefore, a "lite" carcass must contain no more than 23.25 percent fat.

Retail cuts from "lite" carcasses do not automatically qualify to be labeled with the same terminology. These should be analyzed and compared with values in a recent recognized reference source on nutrient content of beef, e.g., USDA's Handbook 8-13.

There is interest on the part of packers in the Southwest to identify carcasses from lightweight heifers that could satisfy current USDA labeling requirements in order to fulfill the needs of the diet-health conscious consumer and improve the commercial value of these animals.

The primary objectives of this research were:

1) To study the relationships among the variables used in the USDA Yield Grade equation when applied to carcasses of lightweight heifers.

2) To estimate the average carcass characteristics and chemical composition of retail cuts at two different trim levels.

3) To develop accurate predictors of carcass chemical composition based on carcass traits that can be rapidly and inexpensively obtained.

4) To provide data necessary so that industry can develop a private branding program.

MATERIALS AND METHODS

A total of 29 sides from lightweight heifers were used in this study. Sides were provided by eight packers located in Texas. Hot carcass weight ranged from 113 to 250 kg, and carcasses were selected as outlined in table 1.

Carcasses were selected by staff from the Texas Agricultural Experiment Station and Texas Agricultural Extension Service. The following information was collected:

- carcass weight, kg
- fat thickness, mm (between 12-13th rib)
- ribeye area, sq. cm (between 12-13th rib)
- estimated percentage of kidney, pelvic and heart fat
- USDA marbling score
- USDA maturity score
- USDA Yield Grade
- USDA Quality Grade

Carcasses were delivered to the Meat Science and Technology Center at Texas A&M University and were held at 4

TABLE 1. CARCASS SELECTION DESIGN FOR SOUTHWESTERN LIGHT HEIFERS.

Carcass Weight Range, kg	Total Sides	Packer ID. Number*							
		1	2	3	4	5	6	7	8
113-135	2				2				
136-157	2						2		
158-180	7		3		1		2	1	
181-202	7	1				1		3	2
203-225	7	2	1	1	1	1			1
226-250	4	1		2		1			
Totals	29	4	4	3	4	3	4	4	3

*Number ID.

1 H&H Foods, Inc.
2 Laredo Packing Company, Inc.
3 Eddy Packing Co.
4 Freedman Packing Co.
5 Gulf Packing
6 Handy Packing Co.
7 Dallas City Packing, Inc.
8 Gooch Packing Co., Inc.

C for 24 h. After this period, carcasses were weighed in air, then immersed in water at 4 C and weighed under water in order to determine carcass density. Carcass fat was calculated using the formula described by Garrett and Hinman (1969).

After a 24 h drying period, carcasses were fabricated into square-cut chucks, ribs, loins and rounds. The neck section, fore and hind shanks, flank, navel and heel of the round were weighed, but not used for the purpose of this study. The four major wholesale cuts were cut as follows:

chuck: 4 arm steaks and 6 blade steaks;

rib: 4 small-end rib and 4 large-end rib steaks;

loin: 4 strip, 4 Porterhouse and 6 sirloin steaks;

round: 1 rump roast, 1 knuckle roast, 2 round steaks, 2 top round steaks and 2 bottom round steaks.

Alternate steaks were trimmed to either 0.64 or zero cm of outside fat. Steaks from the same wholesale cut with the same trim level were ground together by passing the tissue three times through a Hobart grinder (4.8 mm diameter plate). A representative sample was taken and homogenized for 30 s in a Robot Coupe food processor. Samples were stored in 150 ml containers and frozen at -10 C until they could be analyzed for fat and moisture content following AOAC (1980) procedures. Thirty min before samples were weighed for analysis, they were taken out of the freezer and allowed to thaw. Approximately 2 gm of the sample was weighed and placed in prefolded filter paper. The samples were then placed in a drying oven at a temperature of 100 C for 24 h.

After drying, samples were weighed again to determine moisture loss. Samples were then placed in a Soxhlet apparatus and subjected to ether extraction for 12 h. After extraction, samples were removed, allowed to ventilate to remove all ether and placed in drying oven for 24 h before reweighing (to determine fat loss). All samples were run through this procedure in duplicate and only those samples that were within 5 percent variability of each other after computation of percentage fat and moisture were accepted. All others were reanalyzed until acceptable variations were obtained.

Percentage moisture and ether extractable fat at zero and 0.64 cm trim levels were determined for each subprimal which was analyzed.

Statistical analysis included Pearson correlation coefficient and stepwise regression to develop prediction equations. Duncan means separation test was used to separate means. All analyses were conducted using the SAS (1982) package.

RESULTS AND DISCUSSION

Means and standard deviations of characteristics from the carcasses used in this study are presented in table 2. Mean weight, mean fat content as determined by specific gravity, and Yield Grade of the carcasses are considerably

TABLE 2. MEANS AND STANDARD DEVIATIONS FOR CARCASS TRAITS.

Carcass Traits	Mean	SD
Hot carcass weight, kg	189.56	34.63
Side chilled weight, kg	92.83	17.32
Ribeye area, cm^2	65.86	10.65
Estimated KPH[a], %	2.24	.57
Actual KPH[a], %	2.22	.69
Adjusted fat thickness, cm	.54	.17
Actual fat thickness, cm	.41	.14
Final USDA Yield Grade	1.80	.31
Marbling score[b]	206.90	56.39

[a]KPH = Kidney, pelvic and heart fat.
[b]Coded: Practically Devoid^0 = 0; Traces^0 = 0; Slight^0 =200; Small^0 = 300.

less than the estimated for the average beef carcass in the United States (USDA, 1986b). Kidney, pelvic and heart fat percentage was slightly overestimated when compared to actual percentages.

Fat content of retail cuts (lean plus fat) from USDA Choice carcasses (USDA, 1986a) are presented in table 3. These are the official values of fat content of retail cuts and these will be used to compare the values obtained in this study.

Means and standard deviations of the fat content of retail cuts, percentage of retail cuts with less than 10 percent fat and reduction in fat content (compared to USDA's Handbook 8-13, USDA, 1986) for the zero an the 0.64 cm outside fat trim levels are presented in tables 4 and 5, respectively. All the retail cuts trimmed to zero outside fat had less (P<.05) chemical fat than similar retail cuts trimmed to 0.64 cm of outside fat. In the zero outside fat trim level, steaks from the rib (large end), blade and arm sections in the forequarter, and from the sirloin section in the hindquarter, had more (P<.05) fat than the remainder of the retail cuts. Because all retail cuts were trimmed of outside fat at this trim level, intermuscular fat likely accounted for the increase in chemical fat in these cuts. Conversely, retail cuts from the strip section and the round contained the least amount of fat.

TABLE 3. FAT CONTENT OF RETAIL CUTS (CHOICE, LEAN PLUS FAT) FROM USDA'S HANDBOOK 8-13.

Retail Cut	Fat Content, %
Rib steak (small end)	26.73
Rib steak (large end)	32.10
Blade steak	24.41
Arm steak	20.47
Strip steak	23.53
Porterhouse steak	23.27
Sirloin steak	20.67
Knuckle roast	14.10
Rump roast[a]	20.67
Round steak (whole)	17.54
Top round steak	8.97
Bottom round steak	15.77

[a]Same value as Sirloin steak.

TABLE 4. MEANS AND STANDARD DEVIATIONS OF THE FAT CONTENT, PERCENTAGE OF CUTS BELOW 10 PERCENT FAT AND FAT REDUCTION[a] OF RETAIL CUTS TRIMMED TO ZERO OUTSIDE FAT.

Retail Cut	Fat Content, %	SD	% of Cuts Below 10% Fat Level	% Fat Reduction[a]
Rib steak (small end)	7.19	2.41	93	73.1
Rib steak (large end)	13.16	3.16	10	59.0
Blade steak	9.99	2.76	62	59.1
Arm steak	7.91	2.09	90	61.4
Strip steak	4.31	2.11	97	82.7
Porterhouse steak	7.02	2.14	90	69.8
Sirloin steak	8.71	2.69	76	57.9
Knuckle roast	5.32	1.71	100	62.3
Round steak (whole)	4.39	1.19	100	75.0
Top round steak	3.32	1.54	100	63.0
Bottom round steak	4.08	1.28	100	74.1

[a]Compared to USDA's Handbook 8-13 values for Choice lean and fat.

TABLE 5. MEANS AND STANDARD DEVIATIONS OF THE FAT CONTENT, PERCENTAGE OF CUTS BELOW 10 PERCENT FAT AND FAT REDUCTION[a] OF RETAIL CUTS TRIMMED TO 0.64 CM OF OUTSIDE FAT.

Retail Cut	Fat Content, %	SD	% of Cuts Below 10% Fat Level	% Fat Reduction[a]
Rib steak (small end)	15.66	2.72	0	41.4
Rib steak (large end)	17.91	4.17	0	44.2
Blade steak	12.78	3.44	24.1	47.6
Arm steak	13.15	2.85	17.2	35.8
Strip steak	12.24	2.53	34.5	48.0
Porterhouse steak	14.81	2.65	0	36.4
Sirloin steak	14.45	2.49	3.4	30.0
Rump roast	9.08	3.36	17.2	56.1
Knuckle roast	13.99	3.61	72.4	7.8
Round steak (whole)	7.28	1.92	17.2	58.5
Top round steak	6.88	2.03	89.7	23.3
Bottom round steak	9.51	2.93	51.7	39.7

[a]Compared to USDA's Handbook 8-13 values for Choice lean and fat.

In the 0.64 cm outside fat trim level, steaks from the round, knuckle roast and strip steaks also contained the least amount of fat.

Table 6 shows the simple correlations among the carcass traits of the heifers studied. USDA Yield Grade was related (P<.05) to only one Yield Grade factor, ribeye area. The low correlation between USDA Yield Grade and its factors disagrees with other studies (Powell and Huffman, 1973; Kauffman et al., 1975; Crouse and Dikeman, 1976) that have found USDA Yield Grade to be significantly correlated with all its factors. The lack of a significant relationship between Yield Grade and its factors can only be explained if the relationship between the factors was different for lightweight heifers than for cattle from which it was derived. Marbling scores and adjusted fat thickness showed significant correlations with almost all other traits presented. Correlations between fat carcass measurements and carcass hot weight were positive and significant, indicating that carcass fatness increased with increases in carcass weight.

As reported by Hedrick (1983), 9-10-11th rib dissection and round dissection have long been used by researchers as a useful tool to predict carcass composition. Even though in this study, rib (small end) consisted of the rib section containing the 10, 11 and 12th ribs, fat content in the small end rib and bottom round steaks was significantly correlated to fat content of most retail cuts.

TABLE 6. SIMPLE CORRELATIONS AMONG CARCASS TRAITS OF LIGHTWEIGHT HEIFERS.

	Marbling Score	YG[a]	ADJFT[b]	KPH[c]	REA[d]	HCW[e]
Percentage Fat[f]	.37	-.05	.32	.38*	.42*	.36
HCW	.48**	.05	.64**	.38*	.83*	
REA	.53**	-.38*	.63**	.42*		
KPH	.37**	.33	.54**			
ADJFT	.68**	.32				
YG	.08					

[a]USDA Yield Grade.
[b]Adjusted fat thickness.
[c]Estimated kidney, pelvic and heart fat.
[d]Ribeye area.
[e]Hot carcass weight.
[f]As determined by specific gravity.
* P<.05
** P<.01

Because retail cuts used in this experiment were trimmed to two different trim levels, it was necessary to estimate composition as if all the sides had been trimmed at the same level. For this effect, three variables were estimated for each of the two trim levels. These variables and their formulas were:

$$\text{Total trim, kg} = 2 \times (\text{Sum bone, lean and fat trimmed from retail cuts}).$$

$$\text{Percent fat in the composite} = \frac{\text{Sum (\% fat in retail cuts} \times \text{trimmed retail cut weight)}}{\text{Sum weight of all trimmed retail cuts}}$$

$$\text{Percent retail cuts} = \frac{2\ \text{Sum (weight of all trimmed retail cuts)}}{\text{Side weight}}$$

Each one of these variables was calculated for every side for each trim level. Because only one half of the retail cuts were trimmed to each trim level, when calculating total trim (kg) and percent retail cuts it was necessary to multiply by 2 to make up for the difference. The rump roast was trimmed to 0.64 cm of outside fat from all sides and it was not included when calculating these figures at the zero outside fat trim level.

Means and standard deviations of total fat trim, fat percent in the composite, and percentage of retail cuts for each trim level are presented in table 7. Total amount of

TABLE 7. MEANS AND STANDARD DEVIATIONS OF TOTAL TRIM[a] (KG), FAT PERCENT IN THE COMPOSITE[b] AND PERCENTAGE OF RETAIL CUTS[b] BY TRIM LEVEL.

	Outside fat trim level			
	Zero		0.64 cm	
	Mean	SD	Mean	SD
Total trim, kg	20.45	4.22	15.87	3.27
Fat in the composite, %	8.12	1.59	12.23	1.87
Retail cuts[c], %	38.48	2.80	42.18	1.83

[a]Total trim = estimated kg of bone, fat and lean trimmed from wholesale cuts at each trim level.
[b]Estimated weighed composite of all retail cuts at each trim level.
[c]Neck section and heel of the round not included.

trimmed tissue decreased by more than 22 percent from zero to 0.64 cm trim level. Percent fat content increased by more than four percentage points from zero to 0.64 cm of outside fat. Retail cut yield also increased from 38.48 to 42.18 percent by increasing the trim level from zero to 0.64 cm of outside fat.

The mean USDA Yield Grade representing the percentage of boneless, closely trimmed retail cuts does not reflect the estimated percentage of boneless retail cuts trimmed to 0.64 cm of outside fat. The discrepancy among these figures can be accounted for by the fact that in this study the neck section and the heel of the round were not included in calculating retail cut yield. Also, retail cuts from the chuck, rib and loin were trimmed of excessive amounts of intermuscular fat. USDA Yield Grade Standards reflect the percentage of retail cuts trimmed to 1.3 cm (USDA, 1980) and not to 0.64 cm or zero outside fat. The population of carcasses from which USDA Yield Grade Standards were developed was wide and representative of all the carcass classes (Murphey et al., 1960). Because only lightweight heifers were included in this study, the relationship among the factors used for USDA Yield Grade determination in this study may be different from that by which the standards were set. Total retail product yields reported in the literature vary from 67.95 percent in steers to 50.49 percent in heifers (Kauffman et al., 1975; Crouse and Dikeman, 1976; Murphey et al., 1985). Different cutability procedures and levels of trim in retail cuts may also account for these differences.

Multiple regression equations were developed to predict total trimmable tissue (kg) and fat percentage in the composite for both trim levels. These equations are shown in tables 8 through 11. All tables show the best equations developed using the USDA Yield Grade factors, marbling score and USDA Yield Grade. Only significant (P<.05), independent variables were incorporated into the models.

As could be expected from the high correlations between marbling and percentage fat in the composite and with retail cuts, marbling was the most important factor in predicting this variable at the zero trim level (table 8). In equation 2, when the variable KPH was entered in the model, the correlation coefficient increased. At the 0.64 cm trim level, adjusted fat thickness was the most important independent variable in predicting fat percentage in the composite (table 9). The KPH, which showed significant correlation with fat content of the composite, was the second best variable for this model. Ribeye area and USDA Yield Grade, which were only moderately correlated to composite fat content, and marbling score (highly correlated) comprise the equation with the best coefficient of determination.

Hot carcass weight was the best predictor of total kg of fat bone and lean trim at both trim levels (tables 10 and

TABLE 8. REGRESSION EQUATIONS FOR PREDICTING PERCENTAGE CHEMICAL FAT IN THE COMPOSITE[a] AT THE ZERO TRIM LEVEL.

Equation	Independent variables	Intercept	b values	R^2
1	Marbling score[b]	3.94	0.02	.51
2	KPH[c] Marbling score	2.76	0.80 0.017	.59

[a]Refers to the weighed average fat content of the four major wholesale cuts trimmed at this trim level.
[b]Coded: Practically Devoid^0 = 0; Traces^0 = 0; Slight^0 =200; Small^0 = 300.
[c]KPH = Kidney, pelvic and heart fat.

TABLE 9. REGRESSION EQUATIONS FOR PREDICTING PERCENTAGE CHEMICAL FAT IN THE COMPOSITE[a] AT THE 0.64 CM TRIM LEVEL.

Equation	Independent variables	Intercept	b values	R^2
1	Adjusted fat thickness	8.21	7.38	0.51
2	Adjusted fat thickness KPH[b]	7.14	6.12 0.78	0.54
3	Ribeye area, cm^2 USDA Yield Grade Marbling score[c]	-1.53	0.08 3.36 0.012	0.59

[a]Refers to the weighed average fat content of the four major wholesale cuts trimmed at this trim level.
[b]KPH = Kidney, pelvic and heart fat.
[c]Coded: Practically Devoid^0 = 0; Traces^0 = 0; Slight^0 =200; Small^0 = 300.

TABLE 10. REGRESSION EQUATIONS FOR PREDICTING TOTAL TRIMMABLE TISSUE[a] (KG) IN THE FOUR MAJOR WHOLESALE CUTS AT THE ZERO OUTSIDE FAT TRIM LEVEL.

Equation	Independent variables	Intercept	b values	R^2
1	Hot carcass weight, kg	-.26	0.092	0.83
2	Hot carcass weight, kg Adjusted fat thickness, cm	0.41	0.078 4.76	0.86

[a]Refers to the weighed average fat content of the four major wholesale cuts trimmed at this trim level.

TABLE 11. REGRESSION EQUATIONS FOR PREDICTING TOTAL TRIMMABLE TISSUE[a] (KG) IN THE FOUR MAJOR WHOLESALE CUTS AT THE 0.64 CM OF OUTSIDE FAT TRIM LEVEL.

Equation	Independent variables	Intercept	b values	R^2
1	Hot carcass weight, kg	0.016	0.071	0.81
2	Hot carcass weight, kg Marbling score[b]	-.62	0.063 0.011	0.84

[a]Refers to the weighed average fat content of the four major wholesale cuts trimmed at this trim level.
[b]Coded: Practically Devoid^0 = 0; Traces^0 = 0; Slight^0 =200; Small^0 = 300.

11). At the zero outside fat trim level, hot carcass weight was significantly correlated to total kg of trimmed tissue, however there were variables that showed better correlations. When adjusted fat thickness was incorporated into the equation, it increased the coefficient of determination from .83 to .86. At the 0.64 cm trim level, marbling score was the best variable after hot carcass weight.

Due to the economical importance of retail cut yield, it has been the objective of many researchers to develop equations to predict this variable. However, it was not possible to develop regression equations to predict percentage of retail cuts in the carcass at any trim level because none of the independent variables entered in the model was significant or produced appreciable coefficient of determination.

Estimates of fat content of each individual retail cut at each trim level are presented in figures 1 through 23. These values were estimated using only significant values $(P<.05)$. These shoud be used as a quick guide for determining the fat content of individual retail cuts at a given trim level.

CONCLUSIONS

Data collected in this study support the following conclusions:

a) At the level of fatness of the carcasses in this study, specific gravity is not sufficiently accurate as a predictor of carcass composition. Correlations between fat percent as predicted by specific gravity and measurements of carcass fatness were from moderate to low.

b) Trimming to zero outside fat reduced the fat content of retail cuts. In most cases, there was an important reduction to levels below 10 percent, which is the maximum allowable bu USDA to label beef products as "lean".

c) Marbling score and fat thickness were the two best measurements of carcass fatness for trim levels zero and 6.4, respectively.

f) It was possible to develop regression equations to predict the fat content of a composite from the retail cuts, as well as to predict total amount of trimmable lean, fat and bone. The development of regression equations to predict carcass cutability was not possible with the sample size used in this study because there was not enough variability in carcass traits among the carcasses. A greater sample size is recommended if there is a need to develop such equations.

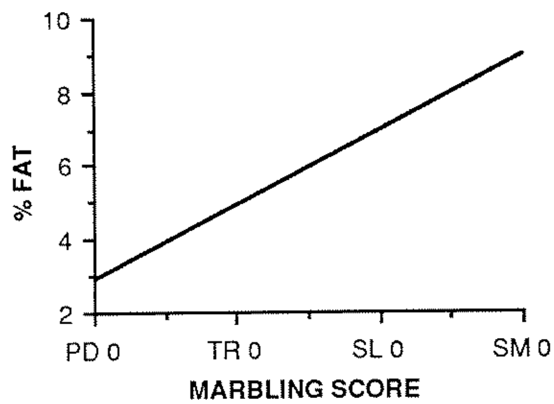

FIGURE 1. FAT CONTENT OF RIB (SMALL END) STEAKS TRIMMED TO ZERO OUTSIDE FAT BY MARBLING SCORE.

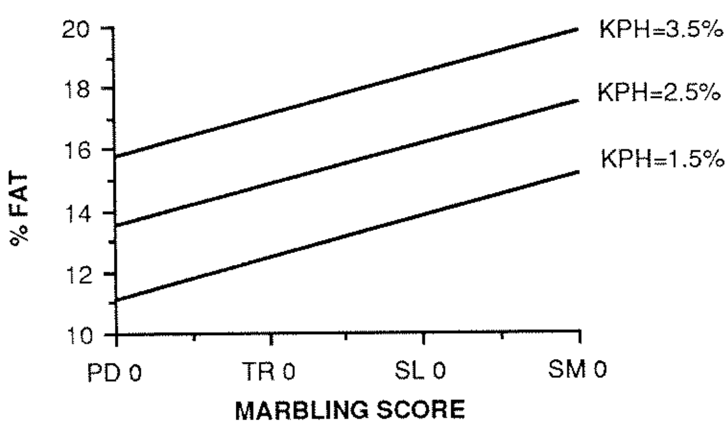

FIGURE 2. FAT CONTENT OF OF RIB (SMALL END) STEAKS TRIMMED TO 0.64 CM OF OUTSIDE FAT BY MARBLING SCORE AND ESTIMATED PERCENTAGE OF KIDNEY, PELVIC AND HEART FAT.

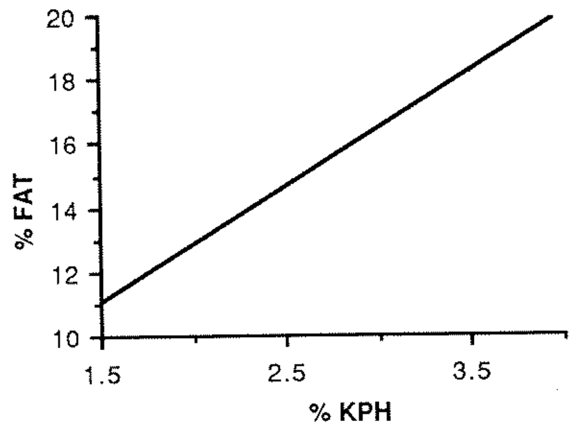

FIGURE 3. FAT CONTENT OF RIB (LARGE END) STEAKS TRIMMED TO ZERO OUTSIDE FAT BY ESTIMATED PERCENTAGE OF KIDNEY, PELVIC AND HEART FAT.

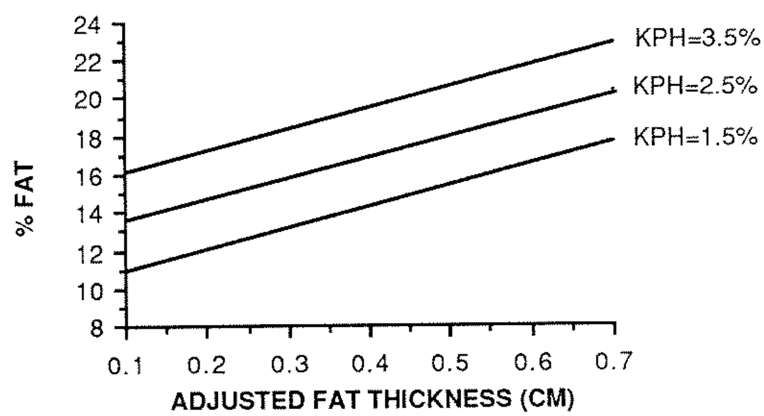

FIGURE 4. FAT CONTENT OF RIB (LARGE END) STEAKS TRIMMED TO O.64 CM OF OUTSIDE FAT BY ESTIMATED % OF KIDNEY, PELVIC AND HEART FAT AND ADJUSTED FAT THICKNESS (CM).

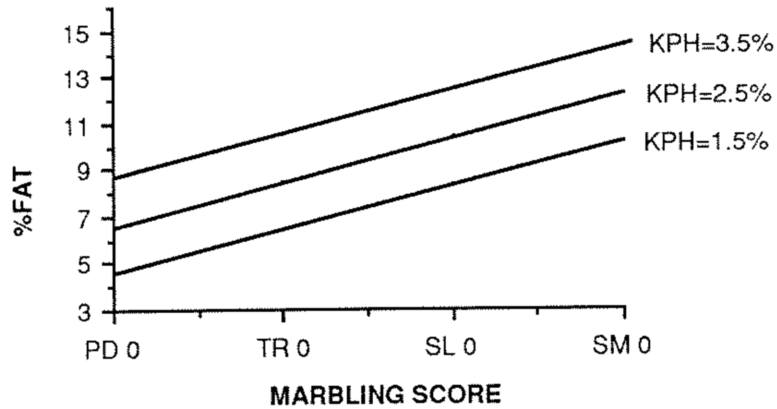

FIGURE 5. FAT CONTENT OF BLADE STEAKS TRIMMED TO ZERO OUTSIDE FAT BY MARBLING SCORE AND ESTIMATED KIDNEY PELVIC AND HEART FAT PERCENTAGE.

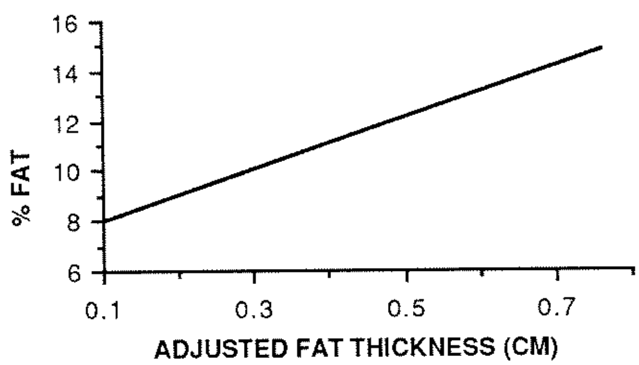

FIGURE 6. FAT CONTENT OF BLADE STEAKS TRIMMED TO 0.64 CM OF OUTSIDE FAT, BY ADJUSTED FAT THICKNESS.

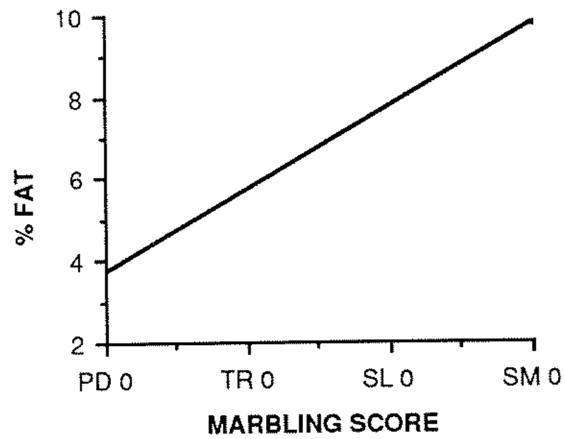

FIGURE 7. FAT CONTENT OF ARM STEAKS TRIMMED TO ZERO OUTSIDE FAT BY MARBLING SCORE.

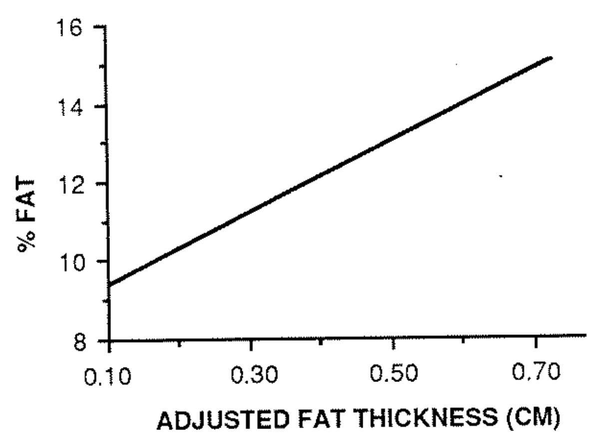

FIGURE 8. FAT CONTENT OF ARM STEAKS TRIMMED TO 0.64 CM OF OUTSIDE FAT BY ADJUSTED FAT THICKNESS.

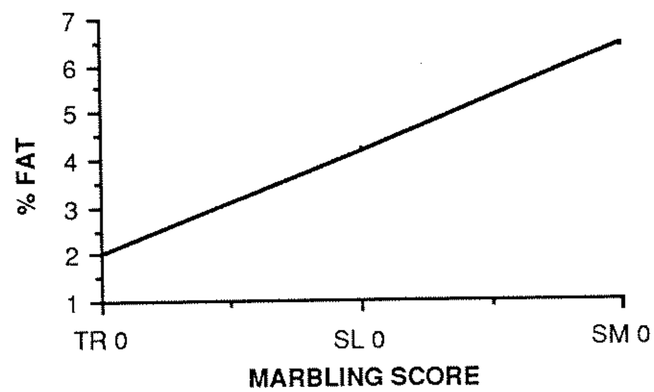

FIGURE 9. FAT CONTENT OF STRIP STEAKS TRIMMED TO ZERO OUTSIDE FAT BY MARBLING SCORE.

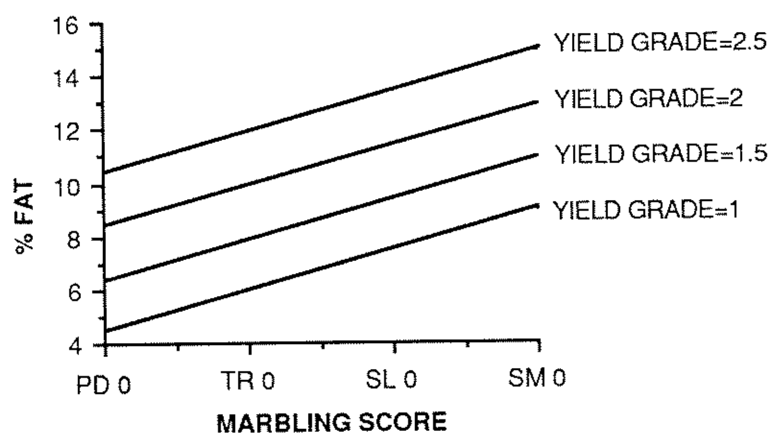

FIGURE 10. FAT CONTENT OF STRIP STEAKS TRIMMED TO 0.64 CM OF OUTSIDE FAT BY MARBLING SCORE AND USDA YIELD GRADE.

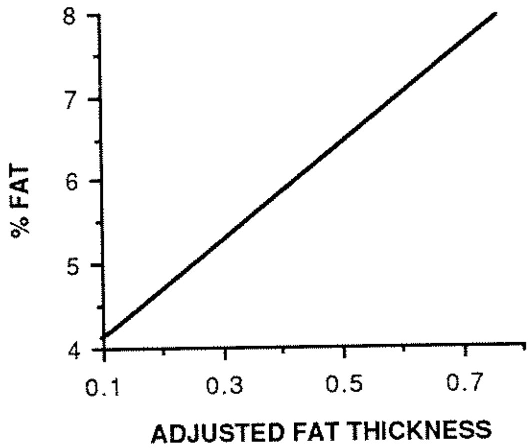

FIGURE 11. FAT CONTENT OF PORTERHOUSE STEAKS TRIMMED TO ZERO OUTSIDE FAT BY ADJUSTED FAT THICKNESS.

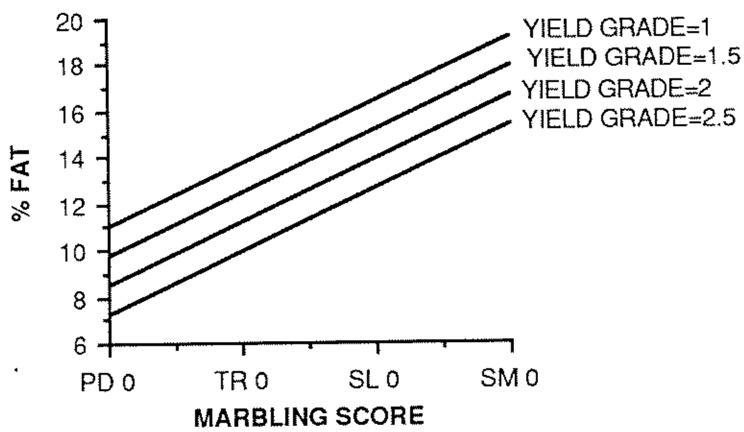

FIGURE 12. FAT CONTENT OF PORTERHOUSE STEAKS TRIMMED TO 0.64 CM OF OUTSIDE FAT BY USDA YIELD GRADE AND MARBLING SCORE.

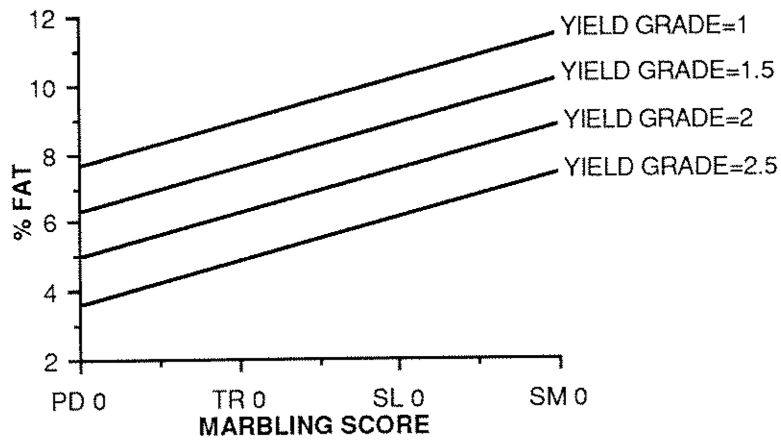

FIGURE 13. FAT CONTENT OF SIRLOIN STEAKS TRIMMED TO ZERO OUTSIDE FAT BY USDA YIELD GRADE AND MARBLING SCORE.

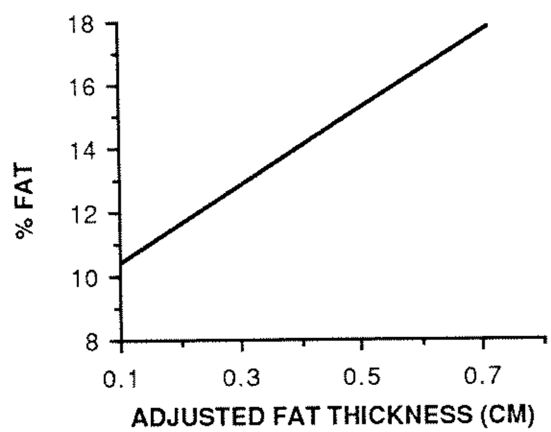

FIGURE 14. FAT CONTENT OF SIRLOIN STEAKS TRIMMED TO 0.64 CM OF OUTSIDE FAT BY ADJUSTED FAT THICKNESS.

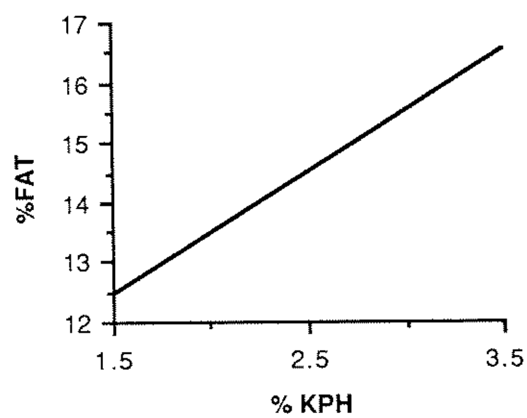

FIGURE 15. FAT CONTENT OF RUMP ROASTS TRIMMED TO 0.64 CM OF OUTSIDE FAT BY ESTIMATED PERCENTAGE OF KIDNEY, PELVIC AND HEART FAT.

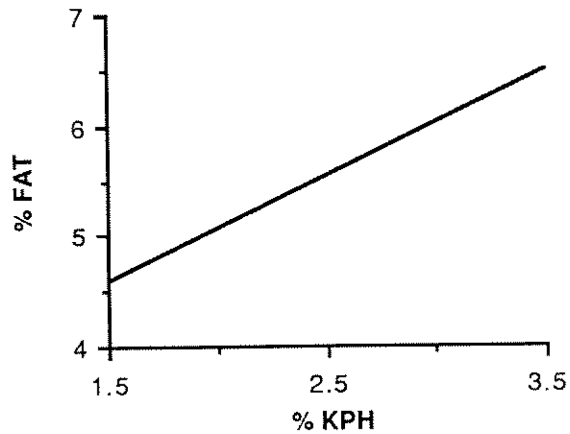

FIGURE 16. FAT CONTENT OF KNUCKLE ROASTS TRIMMED TO ZERO OUTSIDE FAT BY ESTIMATED PERCENTAGE OF KIDNEY, PELVIC AND HEART FAT.

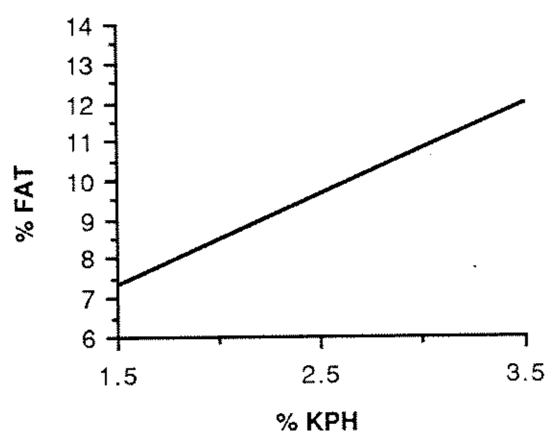

FIGURE 17. FAT CONTENT OF KNUCKLE ROASTS TRIMMED TO 0.64 CM OF OUTSIDE FAT BY ESTIMATED PERCENTAGE OF KIDNEY, PELVIC AND HEART FAT.

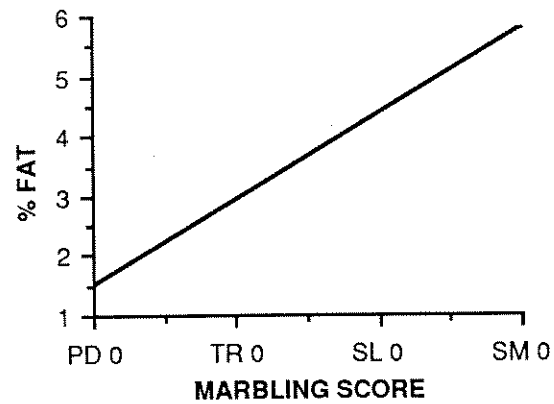

FIGURE 18. FAT CONTENT OF ROUND STEAKS TRIMMED ZERO OUTSIDE FAT BY MARBLING SCORE.

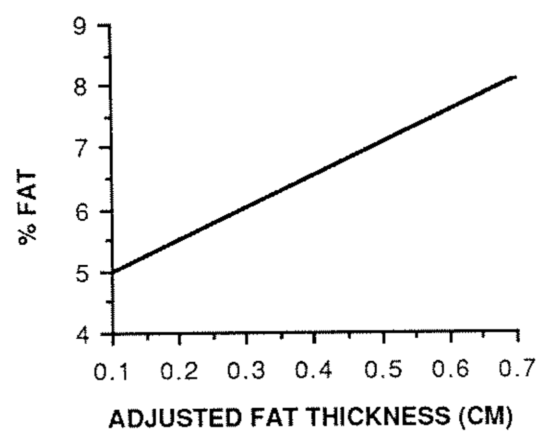

FIGURE 19. FAT CONTENT OF ROUND STEAKS TRIMMED TO 0.64 CM OF OUTSIDE FAT BY ADJUSTED FAT THICKNESS.

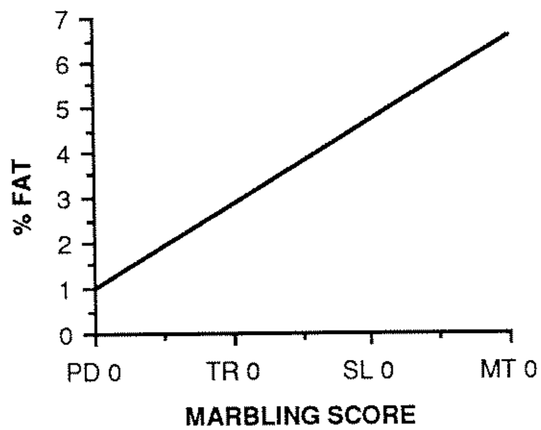

FIGURE 20. FAT CONTENT OF TOP ROUND STEAKS TRIMMED TO ZERO OUTSIDE FAT BY MARBLING SCORE.

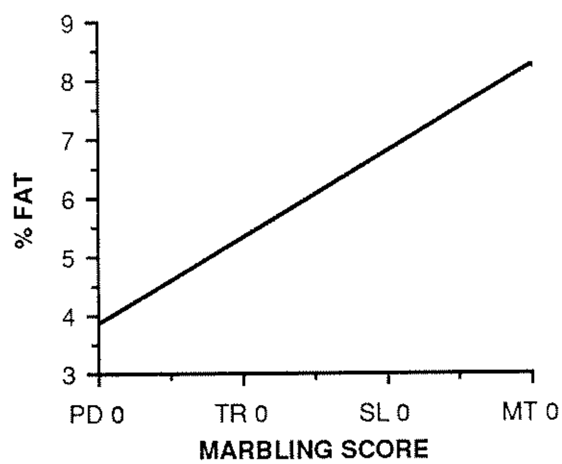

FIGURE 21. FAT CONTENT OF TOP ROUND STEAKS TRIMMED TO 0.64 CM OF OUTSIDE FAT BY MARBLING SCORE.

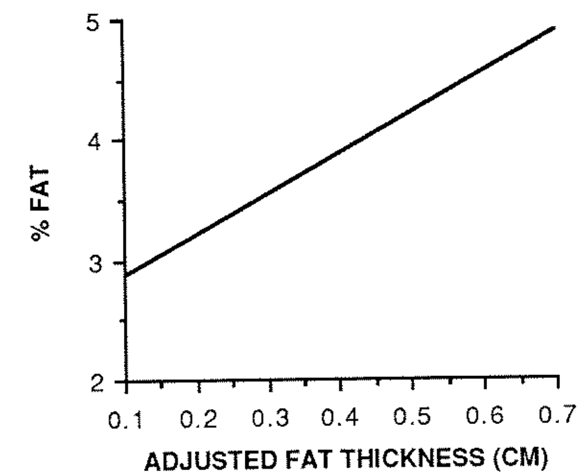

FIGURE 22. FAT CONTENT OF BOTTOM ROUND STEAKS TRIMMED TO ZERO OUTSIDE FAT BY ADJUSTED FAT THICKNESS (CM).

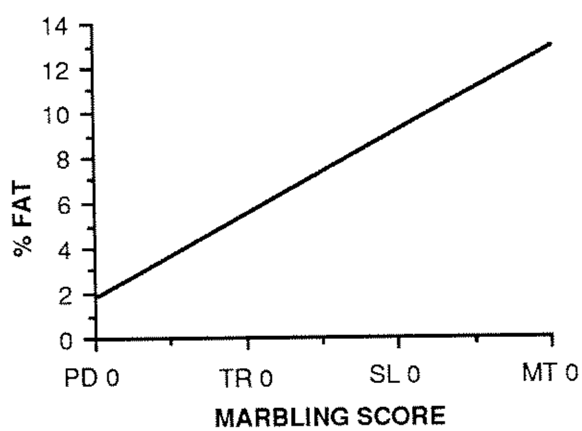

FIGURE 23. FAT CONTENT OF BOTTOM ROUND STEAKS TRIMMED TO 0.64 CM OF OUTSIDE FAT BY MARBLING SCORE.

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